

the mechanics of digestion lies a problem far more complicated, far more difficult to solve, the problem of congenital or acquired hypersensibility to certain stimuli, the question of the overproduction of certain toxic substances, their chemical nature, and their possible specificity, and various questions involving more definitely physical factors, notably absorption and osmosis.

In our series it is hard to escape the conclusion that in the intestine certain substances are produced which in some instances are possessed of specific action associated with a hypersensitiveness to certain proteins not in themselves toxic but possibly capable of producing a reaction because of an acquired hypersensibility, and that therapeutically a marked improvement in symptoms and even a complete cure may be brought about by the elimination of these substances from the dietary. It is also suggested by a study of these cases that by giving these foods in gradually increasing amounts a marked increase in resistance may be produced. That in certain cases at least the symptoms are better explained on the basis of a bacterial infection of intestinal origin rather than upon that of a toxemia, and that in various cutaneous lesions, testing the cutaneous sensibility by intradermal injection of various proteins is of real value in determining whether or not the condition may be due to certain toxic bases of intestinal origin derived from the decomposition of certain protein foods. These reactions are apparently specific in character, that is, are only found to be present when the toxins produced have a specific effect upon the skin, and therefore these tests of cutaneous hypersensitiveness to various proteins probably cannot be used as criteria of other conditions best interpreted as protein intoxications with manifestations elsewhere than in the skin.

### STOCK-BRAINEDNESS, THE CAUSATIVE FACTOR IN THE SO-CALLED "CROSSED APHASIAS."

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"La théorie de la gaucherie cérébrale, pleine d'obscurités, contredite par les faits, ne peut servir à expliquer pour les partisans du centre de Broca les destructions de ce centre sans aphasie."<sup>1</sup>

These words by Pierre Marie and his colleague Moutier, eight years ago, largely formed the basis of a momentous attack on the classical opinions concerning the positions of the centers governing

<sup>1</sup> L'Aphasie de Broca., Moutier, 1908, p. 127.

the functions of speech. As a result of this first onslaught the iconoclasts won for their objections a wide hearing and many disciples, whose ardor has since been somewhat cooled as much by the lapse of time as by the mobilization of the forces of the classicists. Nevertheless, as a result of these dialectics, the whole subject of the causation of the aphasia has been shaken, and not a few of us have failed to decide for ourselves as to the validity of the evidences adduced on both sides.

The cause of this indecision lies in the fact that apparently irrefragable evidence can be produced by both protagonists: by Moutier, for example, the case of Levi,<sup>2</sup> in which Broca's area was destroyed by neoplasm in a right-handed man without any aphasic symptoms having been produced; and, again, the experiments by Burckhardt,<sup>3</sup> who removed from two right-handed demented the foot of the third left frontal convolution without producing the least trace of motor aphasia in either subject.

It may be mentioned here that slowly growing growths destroying the speech area, as in Levi's and Collier's cases,<sup>4</sup> should not be comparable in effects with sudden lesions.

Opposed to these contentions, however, is a vast number of cases, the majority of which have been carefully observed; for instance, the first cases recorded by Broca himself, in which there was complete motor aphasia due to a hemorrhagic cyst in the posterior third of the second and third frontal convolutions; an even more important case than this is that of Simon, in whom a complete inability to communicate except by signs was instantly induced by the traumatic destruction of the left third frontal convolution.

It is not necessary to expand here the number of apparently indubitable cases capable of being cited both for and against the idea that Broca's area is in right-handed persons the brain center specialized for the government of the function of motor speech. It suffices to say that there lay to the hands of Marie and Moutier much evidence which bore heavily against the topographical notions then prevalent, and to remind ourselves that Moutier cites freely cases of right-handed right hemiplegics without aphasia and also cases of left-handed left hemiplegics without any disturbance of their power to converse. Further, the strongest evidence at Moutier's disposal consists of certain patients who might be called, in Bramwell's phrase, cases of crossed aphasia—eccentric combinations of right hemiplegia with aphasia in left-handed individuals, or left-sided palsy with aphasia in right-handed persons.

These cases were used by Moutier to disprove the validity of Broca's area as a special speech center, but in reality, as shall be suggested later, they only impugned the theory of constant con-

<sup>2</sup> Loc. cit., p. 102.

<sup>3</sup> Loc. cit., p. 103.

<sup>4</sup> Collier, *Lancet*, 1899, p. 824.

junction in any one subject of right-brainedness and left-handedness or left-brainedness and right-handedness.

To account for these anomalies there was born of Marie and Moutier the idea that not the area of Broca but the much wider lenticular zone was responsible for language control; a proper scorn is thrown on the clinician who, confronted by a third left frontal convolution destruction in a patient who in life had never been aphasic, falls back feebly on the theory that the said patient must have been left-handed either without self-knowledge of the fact or at least without its discovery by others. However, a language center or intelligence center postulated in the lenticular zone still does not rid us of the difficulty, more especially if the said zone be found structurally normal, as the classicists aver frequently to be the case. Also the clearly cut cases cited by the older writer are not explained away even after the expenditure of much industry and ingenuity.

The conviction grows, therefore, that there is truth in both dogmata, but that adequate explanations of many anomalous cases cannot be given without the injection into the argument of some new factor not as yet brought under scrutiny.

In the most tentative fashion I want to suggest here that the simple statement that a given patient is right-handed or left-handed is not adequate in the light of some cases to be mentioned later. No more information than is contained in this somewhat bald announcement is made by any of the writers on this topic, saving Byrom Bramwell,<sup>5</sup> yet it would appear that not only by investigating the question of a patient's handedness but also that of the prevailing type of handedness in his stock, will we be able to throw some light on a very obscure chapter of neurological medicine.

CASE I.—My first case is that of massive injury (bomb wound) of the right temporosphenoidal and occipital lobes in a left-handed man without left-handed relatives or ancestry. No aphasia.

This patient was wounded on August 15, 1915, near Arras, and admitted to the Hôpital Militaire, Ris Orangis, on September 25. He stated that when making hand grenades he suddenly became unconscious, but he remembered dimly being bandaged in the trench and being carried to the second line. He rapidly recovered complete consciousness and never lost it again. On August 7 he was operated upon at Houdain. No convulsion nor headache. Never any difficulty with speech. His left arm and leg felt as though they had been slept on (*comme s'il avait dormi dessus*). This improved, but was present on admission to the Ris Hospital. He never had had pain in the affected limbs. On September 5 he said he felt very well. There was an infected wound in the right temporal and lower temporoparietal region. Its upper portion was clean, with a

<sup>5</sup> *Lancet*, 1899, p. 1473

granulating surface measuring 8 by  $2\frac{1}{2}$  cm. In the posterior margin of the wound, behind the ear, there was a sinus about 5 cm. long, which extended inward and forward parallel to the external auditory canal. There was a marked bone defect, and the brain pulsated in the granulating area.

Examination showed pupils equal with brisk reactions; sight emmetropic on left side. The right eye was myopic by four diopters. Left homonymous hemianopia complete to fixation point.



FIG. 1 (Case 1).—Showing extent of wound.

Optic discs: The left showed venous tortuosity. The physiological pit was filled in and the left upper temporal quadrant was obscured by slight swelling. The right fundus showed no papilledema.

One may point out here that the formation of the myopic eyeball is such as to permit rapid drainage of fluid accumulated at the nerve head; as a consequence of this, papilledema is not a usual occurrence in myopic eyes. The presence of unilateral myopia in this patient probably accounts for the unilateral fundus changes. There was no nystagmus, diplopia, or strabismus. The lower jaw, on opening the mouth, swung to the right side, this being due not to a lesion of the motor root of the fifth nerve, but to fracture of the zygoma.

The general hypesthesia of the left side was seen in the face as elsewhere, but there was no localized fifth-nerve palsy. The left

lower face was distinctly paresed for both voluntary and emotional movement, thus showing damage respectively to the right facial cortical and the right optic thalamus.

The right membrana tympani had been ruptured and hearing proportionally diminished in the right ear. The tongue swung markedly to the right on protrusion. The swinging of the lower jaw to the right had overcome the tongue's hemiparetic tendency to go to the left. Palatal movements were quite normal.

Motor system: there was distinct and general softening and shrinking of the muscles of the left arm and leg, there being a differ-



FIG. 2 (Case I).—Showing large bone defect and wide distribution of fragments of grenade and bone in the temporo-occipital area.

ence between the left and right upper arm of 2.5 cm.; between the legs of 2 cm. No tremor or athetosis. Slight ataxia of the sensory type existed in the left upper extremity. The weakness in the left arm was more marked than in the left leg, though proportionately less marked than that in the left face. He could not stand on the left leg alone.

There was considerable titubation, probably the result of a lesion of Turck's bundle, uniting the temporal region to the pons. A distinct lowering of touch and superficial pain and deep muscle pain sensation existed over the whole of the left side of the body.

No mistakes were made in sense of position nor in the discrimination of temperature. Some slowness in the recognition of unseen objects held in the left hand, but in this regard also no mistakes were made.

Reflexes: All deep reflexes on the left side were exaggerated in degree. Abdominal reflexes were present on the right and absent on the left side. Plantar reflexes: right flexor, left extensor.

This patient was an intensely left-handed man, using that hand habitually for all complex acts. He had no motor speech difficulty whatsoever; no word deafness; he named promptly and accurately objects of which he had visual recognition. He had no apraxia or alexia. His memory was good. He read and wrote in a manner only interfered with by the complete hemianopia, of which mention has already been made. His father and mother were both right-handed persons. He was an only child, and knew of no other left-handed persons in his connection.

The chief point of interest in this patient seems to lie in the fact that he was left-handed to an extraordinary degree; he reversed the usual position of the knife and fork, and, while he wrote with the right hand, he was equally able to do so with the left.

Under these circumstances it would have been justifiable to have looked for a correspondingly marked disturbance of speech manifested in him as a result of the massive injury sustained by the right temporosphenoidal lobe. This injury not only was inflicted directly on the latter, but the fragments of the grenade and of driven bone are seen roentgenographically to have been flung through the cortex and to have become embedded in the right occipital pole.

The symptomatology here manifested has been presented in some detail in order that there may be shown the extensiveness of the disorganization of widely separated areas in the right brain. We are, therefore, not straining our postulate if we suppose that in this case we have to deal not only with an injury to the right transverse gyri of Heschl, but also with one affecting the commissural fibers between them and the homolateral half center of vision.

In the descriptions of the type of speech defect consequent upon temporal lesions there has been much fluctuation of opinion. Even the most recent text-books reproduce the idea that word-deafness is characteristic of lesions in the speech area of these regions, ignoring the evidence which goes to show that only the most sudden catastrophe successfully destroying at a blow the transverse gyri will produce such an aphasic extremity. The intermediate defects produced by disease processes are manifested, not by a cleanly cut inability to comprehend heard words, but by a depression of power to recall words voluntarily, especially the names of persons, places, and things.

To this phenomenon is usually added that of failure to name an object of which there is visual recognition. These two defects are, at first sight, almost of identical nature and origin, but it may be

pointed out that the former depends on a depression of function in the cortical area containing the memories of words, while the latter arises from an interruption of the subcortical fibers uniting the visual and auditory centers.

In this patient, then, we have, to a maximum degree, an injury which, according to the teachings both of the classicists and their assailants, by its rapidity and extent, should have produced a maximum disorder of speech. There was no disorder.

In the literature of aphasia one finds that but few cases disagree with the general hypothesis that in right-handed persons the centers of language are situated on the left side of the brain. In a few instances in which aphasia has resulted from injury to the right brain some anomalous and adventitious circumstance has usually been brought forward to account for the situation. For example, it was found by Oppenheim<sup>6</sup> in two cases of affection of the right temporal convolution that in one there was acquired left-handedness in a woman, aged fifty-nine years, who had been found to use her left hand for all purposes owing to injury at the age of seventeen years; in the other case there were two tubercles in the right temporo-sphenoidal lobe, and aphasia is reported only to have appeared when the patient was already moribund, and, according to Oppenheim's assumption, as a result of toxic action on the auditory center in the left side of the brain.

Again, Long,<sup>7</sup> after describing a case of embolic right-sided hemiplegia with sensory aphasia in a left-handed woman in whose brain was found a wide-spread destruction of Broca's area and annectant gyri, accounts for the absence of motor aphasia symptoms by the hypothesis of an immediate assumption of speech function on the part of the uninjured hemisphere, as casuistic a theory as can easily be found even in the literature of this somewhat nebulous topic.

No such peculiar or recondite data are obtainable in this case to account for the escape of speech faculties supposedly resident in a portion of highly damaged brain tissue. In view of the seriousness of the lesion it is only possible for us to suppose that the patient's immunity from this disaster lies in the fact that, despite his left-handedness, he is also left-brained. An adumbration of why this may be so is the *raison d'être* of this discussion.

The second case to which I wish here especially to refer is one published by Byrom Bramwell.<sup>8</sup>

CASE II.—A man, aged thirty-six years, suffered from embolic right-sided hemiplegia and aphasia. He was left-handed and had been so all his life. He did everything but write with his left hand. None of his near relatives or ancestors were known to be left-handed. He was a twin; his twin brother was right-handed. The explanation

<sup>6</sup> Quoted by Bruns in *Geschwülste des Nerven systems*.

<sup>7</sup> *L'Encéphale*, 1913, viii, 520.

<sup>8</sup> *Loc. cit.*

given by Bramwell of this individual's peculiar reaction to his vascular accident is that, in spite of his left handedness, the left brain was educated as a speech area by reason of his having been taught to write with his right hand. However, I would point out that perhaps not sufficient weight is given to his isolation as a left-handed person in a stock entirely right-handed; and also that Bramwell's theory does not explain such cases as that reported by Senator:<sup>9</sup> an embolic left hemiplegia with aphasia in a right-handed individual. It is most unfortunate that it was impossible for Senator in the case of this woman to discover whether or not her stock contained a left-handed strain.

The third case was seen by me in the New York Hospital—a completely left-handed man in the service of Dr. Charles Gibson, with whom I saw him in consultation. He had sustained a fracture in the right occipitotemporal region with right middle meningeal hemorrhage.

Craniectomy had been performed, a bone defect of two by four inches having been made over the affected areas.

Following the injury the patient had suffered a left hemiplegia, from which he had recovered at the time of my examination. At intervals, however, he suffered from severe left-sided convulsions.

Despite his left-handedness, which was complete except for writing, associated with a severe injury to the right brain, he never had had the slightest interference with the function of speech.

This patient's relatives were all right-handed. He had lived, as had the French soldier whose condition was first described, as a member of a village community, in which, in both instances, were included many of their relations. Each man was quite positive that he was the only left-handed member of his stock.

We have now considered three cases of left-handed persons in whom brain injury produced phenomena opposed in their combinations to what we should expect in the light of our usual teachings. It is proper, then, to consider a like number of right-handed individuals showing similar peculiar results from similar cerebral catastrophes.

One may point out that, in the first set, our evidence as to each patient's variation from his stock-handedness must be of a negative character; but in the three cases now to be described, each right-handed individual can designate specifically relatives individually peculiar in that they differ from ordinary mankind in using their left hands for all complicated activities.

The first of this second series (Case 4) is that of a right-handed girl, aged twenty-two years, of whom I had charge in the service of Dr. James Taylor at the National Hospital in London. This patient repeatedly had severe attacks of Jacksonian convulsions confined

<sup>9</sup> *Charité annalen*, 1904, xxviii, 150.



to the left side of the body. These fits, occurring under observation over a period of twelve months, were always followed by a severe transient left hemiplegia and equally severe transient aphasia. The patient, herself right-handed, had a left-handed father and a left-handed mother, both of whom presented themselves for observation.

For the reports of the next two cases I am indebted to Dr. Charles Elsberg and Dr. E. D. Fisher respectively.

The history given by the former (Case 5) is that of a young man suffering from a right-sided deeply subcortical Rolandic glioma, on whom was performed at the New York Neurological Institute a right subtemporal decompression. He had complete aphasia for ten days following the operation. He was himself right-handed, but had two brothers both of whom were left-handed.

Patient.	Individual handedness.	Stock handedness.	lesion.	Physical results of lesion.	Speech.
Male, aged 25 years	Left-handed	Right-handed	Grenade wound right temporo-sphenoidal and occipital lobes	Left hemiplegia Left hemihypesthesia Left homonymous hemianopia	No disturbance.
Male, aged 36 years	Left-handed	Right-handed	Left brain embolus	Right hemiplegia	Aphasia.
Male, aged 23 years	Left-handed	Right-handed	Right middle meningeal hemorrhage; skull fracture	Left hemiplegia Left-sided focal epilepsy	No disturbance.
Female, aged 22 years	Right-handed	Parents both left-handed	Right Rolandic tumor (gumma)	Left-sided focal epilepsy; transient attacks of left hemiplegia	Complete aphasia after each fit.
Male, aged 28 years	Right-handed	2 brothers, left-handed	Right subcortical Rolandic glioma; right subtemporal decompression	Slight left hemiplegia	Aphasia.
Female, aged 67 years	Right-handed	Mother, brother, daughter all left-handed	Right brain hemorrhage	Left hemiplegia	Aphasia.

The last case (Case 6) is that of a woman, aged sixty-seven years, under the care of Dr. Fisher. She had sustained a cerebral hemorrhage, as a result of which she had a left hemiplegia and a considerable degree of sensorimotor aphasia. She was right-handed, but her mother had been left-handed. She had a left-handed brother and a left-handed daughter.

The reasons why 95 per cent. of the human race are right-handed have been debated without definite conclusion for the past thirty years. An enormous number of theories have been elaborated, and to almost all of them many objections can be raised.

Barnes<sup>10</sup> is content to say that right-handedness is essentially hereditary, while Gowers<sup>11</sup> quotes the amazing notion that insofar

<sup>10</sup> Lancet, 1903, i, 331.

<sup>11</sup> Lancet, 1902, ii, 1719.

as the human family took origin north of the equator, our first ancestors, seeing the sun travel from left to right, through manual demonstration of the fact and graphical reproduction of it, would naturally lay down in themselves the primitive elements of dexterity. Almost as difficult of proof are the hypotheses which endeavor to explain our asymmetry through the different widths of the carotids, the different blood-pressures in these vessels, and their differences in anatomical origin.

Schaeffer<sup>12</sup> reports five right-handed cases, all with visceral transposition, as evidence against the theory that the right-sided position of the liver should inevitably make us more ready to employ the homolateral arm and hand.

Also Bastian's statement<sup>13</sup> that the specific gravity of the left brain is greater than that of the right, has not met with corroboration and if it had been confirmed, would not materially assist in laying bare the underlying factors of the condition.

Dareste<sup>14</sup> has advanced an interesting hypothesis to the effect that the embryo, applied first to the vitellus by its anterior surface, invariably turns on itself and becomes applied, in the majority of cases, by its left side. He asserts, with little enough proof however, that in this way development of the left side is impeded.

An almost identical theory is put forward by Brandt,<sup>15</sup> and a parallel idea from a strange source, that of the aborigines of North Queensland, is to the effect that right and left-handedness depends entirely on the side of the mother to which the infant presents at the moment of birth.<sup>16</sup>

It is apparently certain that all animals, notably the anthropoid apes, are either handed, and from protopaleolithic implements found in France and Kent it would seem that among our primeval forebears the domination of the left hand was as usual as that of the right.<sup>17</sup> The directions of the flakings on primitive meat and corn crushers of the neolithic period would seem to point to the same conclusions. A gradual recognition in the minds of the earliest men of the necessity of shielding the heart may have led to a tendency to right-handedness which has been transmitted to the bulk of the human family.

Stier<sup>18</sup> in 5000 soldiers found only 4.6 per cent. left-handed, but in over 60 per cent. of these there was obtained a very definite history of a sinistral tendency in the stock of each individual examined.

The percentage of cases in which this left-handed trend is present

<sup>12</sup> Berlin. klin. Wehnschr., 1911, No. 7, p. 295.

<sup>13</sup> Jour. Ment. Sci., 1866, p. 28.

<sup>14</sup> Bull. de la Soc. d'anthropologie, 1885, 415.

<sup>15</sup> Biolog. Centralblatt, 1913, xxxiii, 361.

<sup>16</sup> Chamberlain, Science, 1903, xviii, 788.

<sup>17</sup> Astley, Lancet, 1901, i, 1246.

<sup>18</sup> Monograph, Jena, 1911.

in the forebears must be—and this also is affirmed by Stier—very much larger than can be easily proved by direct statistics.

It would appear, then, that from the cases reported that this trend when present in the stock may produce in the few right-handed individuals of the sinistral stock a condition of brain similar to their collateral relatives and ancestors, with the result that the speech area in such persons becomes developed in an ectopic position. Likewise a left-handed person occurring eccentrically in a right-handed stock is dominated by the trend of that stock rather than by his own individual peculiarities.<sup>19</sup>

These matters would seem to be of small enough practical importance, but one may suggest that the considerations in favor of and against cranial operative procedures are not infrequently influenced by the fear of destruction of the areas governing the function of speech. On this account, apart from the academic interest of the question, it behooves us to record any facts seeming to assist us to increased accuracy of endeavor.

### **CIRCUMSCRIBED CYSTS OF THE LEPTOMENINGES, WITH THE REPORT OF A SUCCESSFUL OPERATIVE CASE.**

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CIRCUMSCRIBED cystic spinal meningitis is not an uncommon cause of spinal cord compression, and since operative interference offers prompt relief from an otherwise progressive and irreparable injury, its early recognition is of great importance. Among 45 cases operated upon for suspected tumor of the cord by Krause,<sup>1</sup> cystic meningitis or, as he terms it, arachnitis adhesiva circumscripta was found in 11, or about 24 per cent. Despite the fact, however, that cystic spinal meningitis can no longer be regarded as a rarity, the literature upon the subject is still very scanty and a general knowledge of the condition is lacking.

Spiller<sup>2</sup> wrote in 1908: "A collection of the clear fluid in a cyst

<sup>19</sup> July 26, 1916. Man, aged thirty-one years. Seen in Bellevue Hospital. Almost complete palsy of left face and left arm, much weakness in left leg; left homonymous hemianopia; left hemianesthesia. Probable luetic cerebral thrombosis. Left-handed from infancy; prefers to write with the left hand. Never any speech difficulty even immediately following onset. Patient is the only left-handed individual in a family of seven, and in a large connection the members of which are well known to him.

<sup>1</sup> *Surgery of the Brain*, iii, 1055 (Rebman, New York).

<sup>2</sup> *AM. JOUR. MED. SC.*, 1909, cxxxvii, 95.